# 10-5
# Base e and the Natural Log

$$e = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$$

| n | e |
|---|---|
| 1 | $(1+\frac{1}{1})^1 = 2$ |
| 10 | $(1.10)^{10} = 2.5937$ |
| 100 | $(1+\frac{1}{100})^{100} = 2.7048$ |
| 1000 | 2.7169 |
| 10,000 | 2.7181 |

$e = 2.71828\ldots$

$\log_e x = \ln x$

"The natural log"

| Logarithmic Form | Exponential Form |
|---|---|
| ln 14 = 2.64 | $e^{2.64} = 14$ |
| ln 22 = 3.09 | $e^{3.09} = 22$ |
| ln 1.22 = 1/5 | $e^{1/5} = 1.22$ |
| $\ln 54.6 = 4$ | $e^4 = 54.6$ |

Simplify:

$\log_5 5^4 = 4$

$\ln e^4 = 4$

$\ln e^2 = 2$

$\ln \frac{1}{e^3} = -3$

Simplify:

$\ln 1 = 0$

$\ln \sqrt{e} = \frac{1}{2}$

$\ln e = 1$

Simplify:

$e^{\log_e 17} = 17$

$e^{\ln 17} = 17$

$e^{\ln 12}$

Solve

$\ln 3x = 2$

$\frac{e^2}{3} = \frac{3x}{3}$

$\frac{e^2}{3} = x$

$2.463 = x$

## Solve

$\ln (x-5) = 2$

$e^2 = x - 5$

$e^2 + 5 = x$

$12.389 = x$

## Solve

$\ln 2x + \ln x = \ln 8$

$\ln 2x^2 = \ln 8$

$2x^2 = 8$

$x^2 = 4$

$x = \pm 2$

## Solve

$e^{4x} = 24$

$\ln e^{4x} = \ln 24$

$4x = \ln 24$

$x = \frac{\ln 24}{4} \approx .7945$

If interest is compounded continuously, use the formula:

$A = Pe^{rt}$

A = amount
P = principal
r = rate
t = time

$A = Pe^{rt}$

If $1,000 is compounded continuously at 6% interest:

- How much money would there be in one year?
- How much money would there be in 8 years?

$A = 1000e^{.06(1)}$ $1061.84

$A = 1000e^{(.06\cdot 8)}$ $1616.07

How long would it take that same principal to reach at least $1350.

$1350 = 1000e^{.06t}$

$1.35 = e^{.06t}$

$\ln 1.35 = \ln e^{.06t}$

$\frac{\ln 1.35}{.06} = \frac{.06t}{.06}$

$5 = t$

about 5yrs

HW

p558

30-51 x3, 28, 54, 58, 59

multiples of 3